

Screw removal and cleaning

Filament Maker TWO

Introduction

The screw of the Filament Maker TWO can be removed entirely from the system, to clean both the extruder screw as the barrel of the machine. It is a lengthy and risky procedure so continue with the upmost attention and safety.

This procedure requires the extrusion system to be hot and filled with melted plastic. For ease and reduced risk of damage, we recommend using 3devo supplied HDPE. Once the machine is switched off, the heaters will slowly lose heat and the HDPE in the barrel and screw will cool down, slightly contract and solidify.

Removing the screw is easier when the material is still hot and partially melted. This is approximately within 30 minutes of switching off the Filament Maker TWO.

It's important to move at a steady but safe pace.

Tools and Consumables

The tools and consumables required for the procedures are listed and categorized as follows:

- **Common tools:** These tools are not provided by 3devo, but are required to perform maintenance tasks and part replacements. They can easily be sourced locally.
- **Specialized tools:** These tools are provided by 3devo to perform maintenance.
- **Consumables:** These consumables are provided by 3devo and machine specific.
- **Additional tools and machinery (optional):** These tools are not provided by 3devo and are optional for cleaning purposes.

Common tools

- long nose pliers, to remove plastic residue
- tweezers, to remove plastic debris
- wrench 21mm, for the nozzle, and nozzle adapter
- heat resistant gloves
- 2.5mm Allen key, for panel screws
- 5mm Allen key, for H4 bolts
- 4mm Allen key, for screw and washer that holds key in place
- 5mm Allen key, for 4 flange screws

Specialized tools (available from 3devo, part of Screw Removal kit)

- brass brush & extension, to clean inside the barrel
ONLY rotate clockwise otherwise the bristles will get flat
- barrel hook wrench (nr.40, 30-32mm)
- die head hook wrench (nr.40, 52-55mm)
- extruder screw removal flange & threaded rod

Consumables (available from 3devo):

- Graphite gasket, installed between barrel and die head (part of Screw Removal kit)
- Nozzle adapter, connects die head to nozzle
- Nozzle gasket x2, installed on both ends of the nozzle adapter
- Nozzle
- Nozzle cover, installed between outside of nozzle and nozzle plate

Additional tools and machinery (optional)

- (household) oven, to heat up the extrusion screw and soften remaining polymer
- blow torch, to heat up the extrusion screw and soften remaining polymer
- ultrasonic cleaner, to clean the polymer from the extrusion screw

Extrusion Screw Removal and Cleaning Steps

Safety

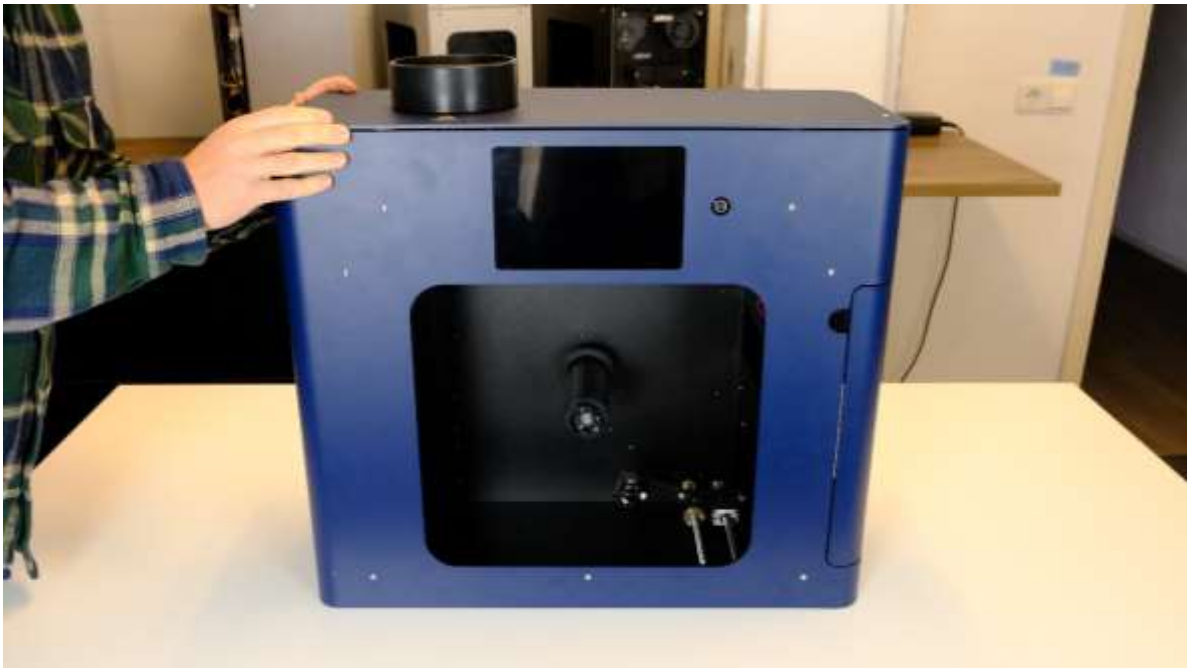
1. Carry out procedure with two persons!
2. Hazards of burns! Use necessary tools and protective equipment.

Preparation

Removing the screw is easier when the material is still hot and partially melted. This is approximately within 30 minutes of switching off the Filament Maker TWO. It's important to move at a steady but safe pace.

Step 1: Prepare the machine

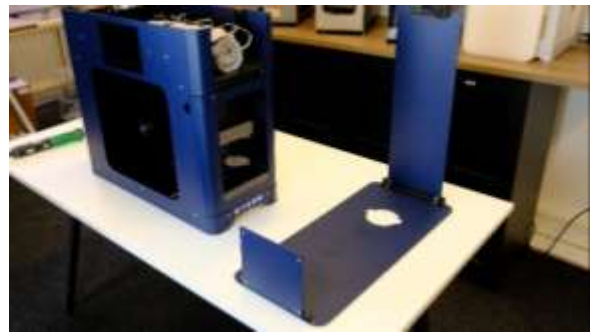
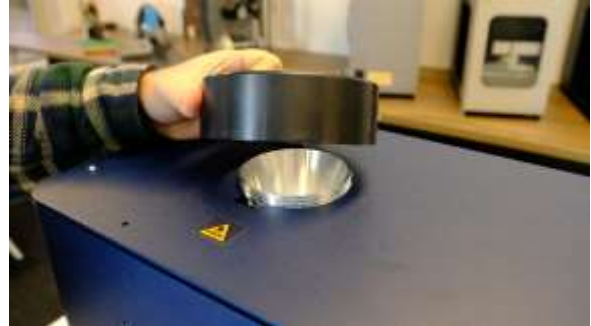
1. Extrude HDPE at 200 degrees on all 4 heaters.
2. Stop extrusion by setting all Heaters to 0 degrees and hit 'Confirm'.
3. Stop screw rotation by pressing 'Stop' on screw speed.
4. Switch off machine with the power button at the back.
5. Unplug from power.
6. Hoover out hopper.
7. Remove extrusion bib, if installed.



Step 2: Remove panels

1. Remove 4 bottom screws from the back panel. Leave the top 2 screws in.
2. Remove the 2 bottom screws from the front panel just above the extrusion door. Leave the top 2 screws in.

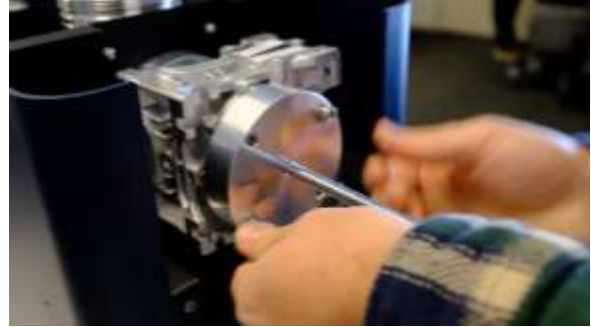
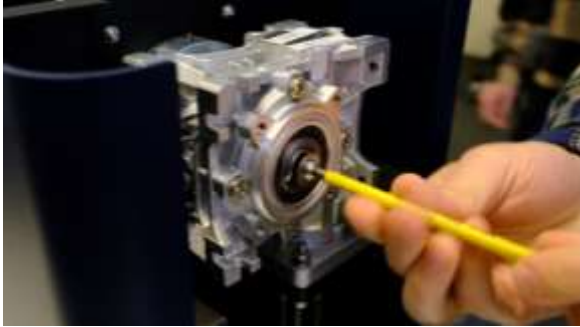
3. Remove the 4 middle screws (out of 8) from the top panel. Place the 10 screws on the side.
4. Unscrew hopper.
5. Remove the 3-sided panel assembly and place safely on the side.



Disassembly

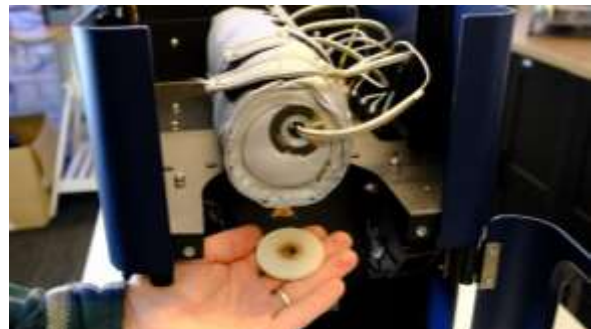
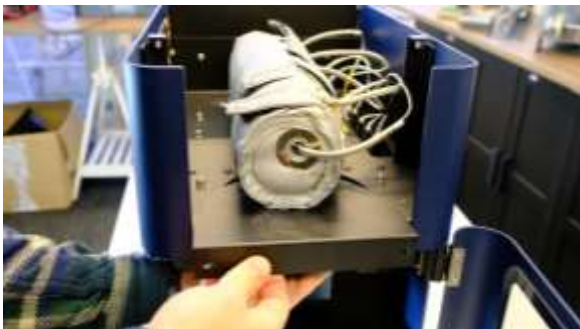
Step 3: Prepare the barrel

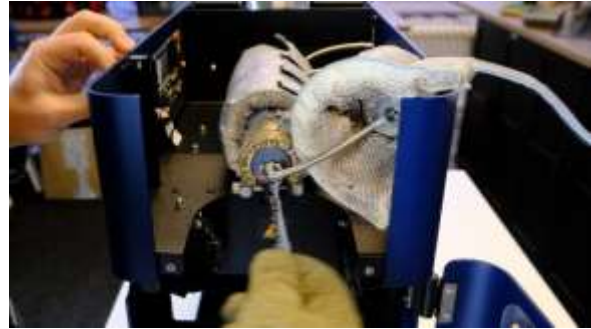
1. Remove the screw and washer from the back of the extrusion screw. This holds the extrusion screw key in place.
2. Attach the flange to the gearbox with the 4 screws. Tighten.



From here onward, **use heat resistant gloves when necessary! Everything attached to the barrel is hot!** This includes the extrusion screw, nozzle, die head, nozzle adapter, and the heaters. **Take care! If the metal wrench or any other tool is attached to any part of the barrel too long, it can also heat up and cause burn!**

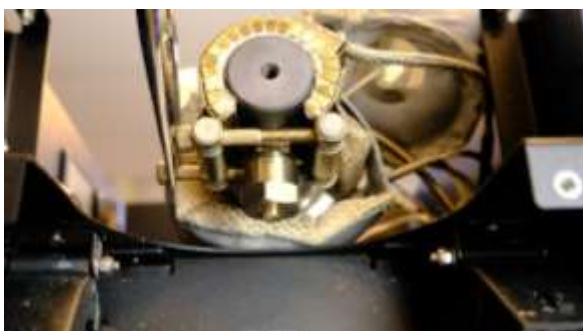
3. Remove nozzle plate. Be careful to catch nozzle cover. Place both on the side.
4. Undo the two velcro straps from the H4 insulation sleeve.
5. Using heat gloves, slide insulation sleeve off H4. First, slip the sleeve carefully off the nozzle from underneath, and then the thermocouple too. Place on the side.
6. Unscrew thermocouple and detach thermocouple from die head.





Step 4: Remove H4

1. There are two bolts underneath H4 clamping it to the barrel. Loosen the front one (closest to nozzle).
2. Unscrew and remove the back one completely. Place on the side.
3. With heat resistant glove carefully remove H4 itself and place on top of insulation sleeve. Now the die head is exposed.

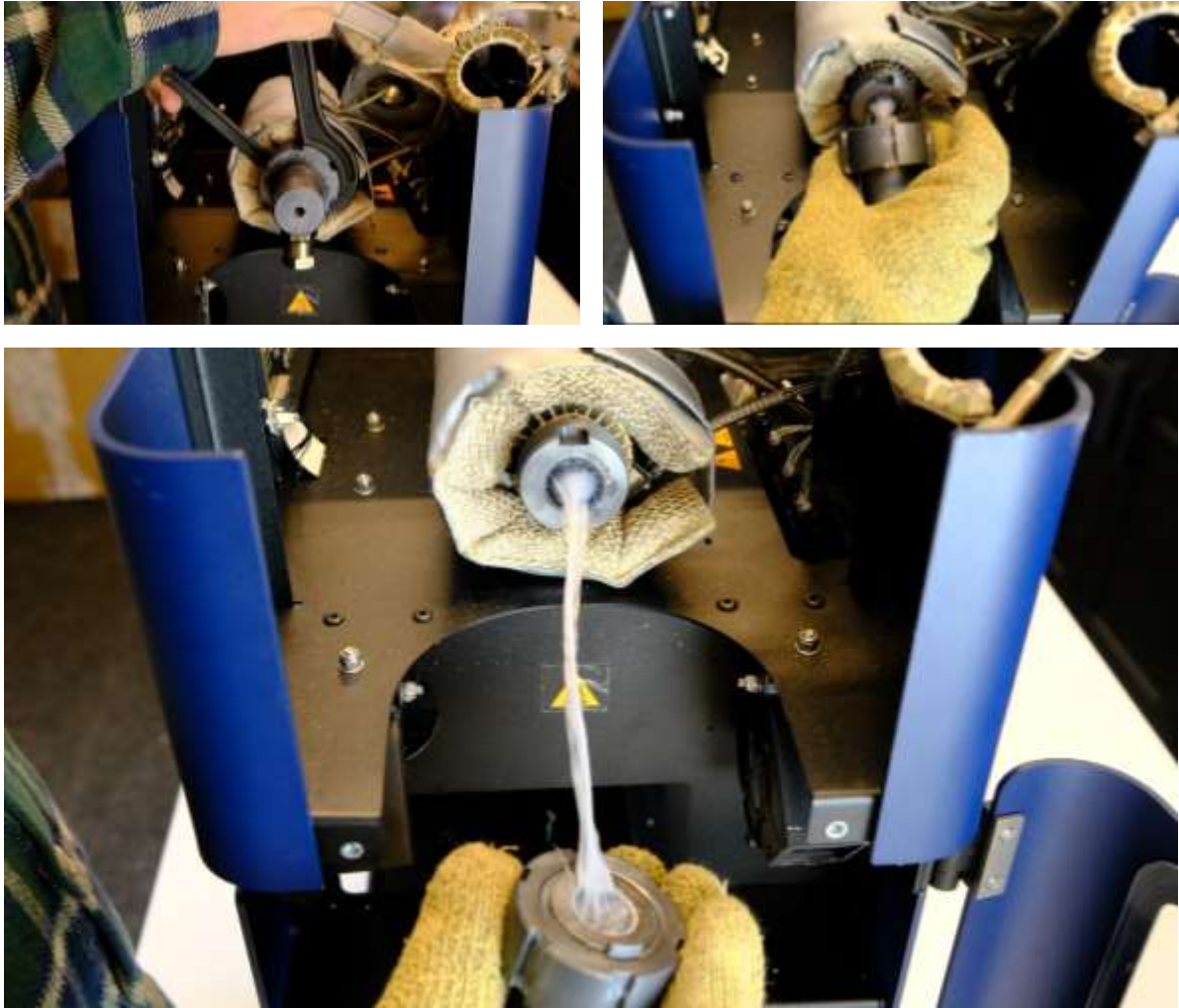




Step 5: Remove the Die head

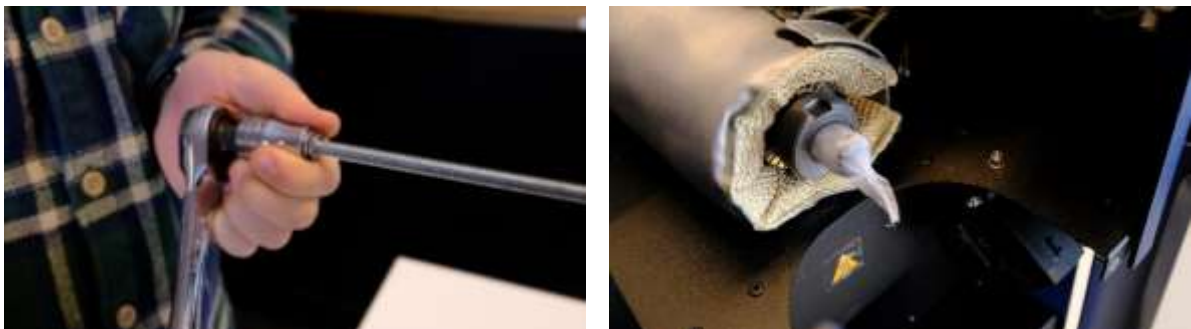
1. Set one of the hook wrenches into the notch on the underside of the barrel. You might need to slightly push the insulation sleeve back.
2. Set the second hook wrench on the die head in the opposite direction.
3. Turn the second hook wrench to unscrew the die head, while holding the first hook wrench as counter. Once the die head turns easier, you can use heat resistant gloves to completely unscrew it.
4. Using heat resistant gloves, remove the die head. Place safely on the side. You might need to cut half melted or solidified string of plastic.
5. Remove both hook wrenches or otherwise they will become hot!

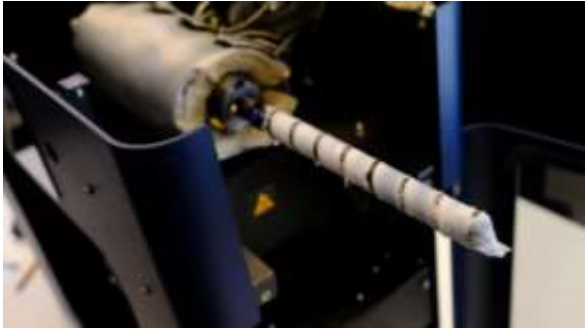




Step 6: Remove the screw

1. Start turning the screw of the threaded rod. This will push out the extrusion screw in a forward movement. An electric screwdriver may be used to speed up the process if the threaded rod is loose enough.
2. At some point loose unmelted pellets will fall off the back end of the screw which is normal. Once all the plastic is exposed, the screw can easily be slid out. Remove the screw with the heat resistant glove.





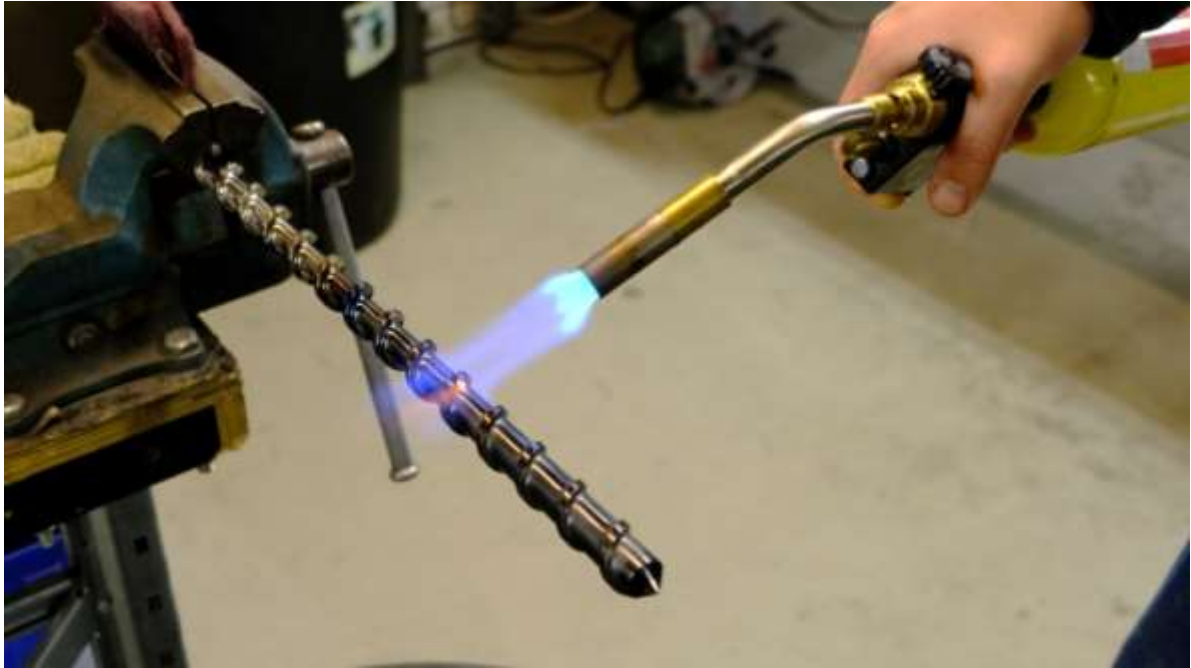
Cleaning

The cleaning of the screw, adapter, nozzle, and diehead is done at work station with a vise, blow torch, optional oven, and ultrasonic cleaner. If the parts cool down fast, it might be necessary to heat them up with an oven or blow torch before removing any plastic residue. **Wear eye protection and heat resistant gloves.**

Step 7: Clean the screw

1. Placing the screw in a vise, you can begin cleaning.
2. Using pliers or tweezers, you might be able to unwrap the remaining plastic in one piece. You can continue to clean the screw and remove any additional pieces of residue.
3. Optional:
Use blow torch to heat up the screw and/or burn off any remaining residue.
Put the screw in an **Ultrasonic cleaner** to remove the remaining residue.





Step 8: Die head, nozzle, and nozzle connector disassembly and cleaning

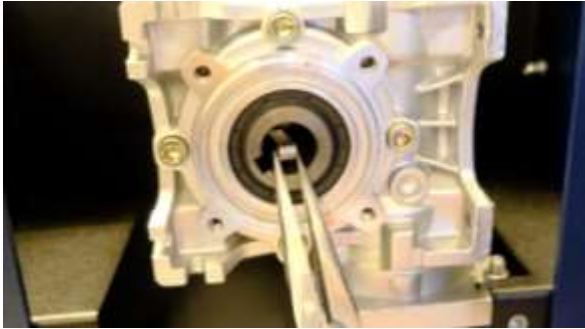
1. Place the die head subassembly in a vise, and turn the nozzle with a 21mm wrench until it comes off. The nozzle can be hot, ensure to use heat resistant gloves.
2. Remove and discard any plastic with tweezers or a pair of long nose pliers.
3. Remove the nozzle gasket.
4. Change the orientation of the die head in the vise and remove the graphite gasket.
5. Continue cleaning and removing any plastic residue.
6. Place the nozzle adapter in a vise and unscrew the nozzle adapter.
7. Clean any remaining polymer residue inside the nozzle adapter, and nozzle.





Step 9: Clean the barrel

1. Remove the flange and threaded rod from the back of the machine.
2. Remove screw key. Place on the side.
3. Now that the barrel is accessible, use the brass brush to clean the inside of the barrel. Take care to only rotate the brass brush clockwise and damage the bristles.
4. To finish up cleaning, use the other side of the brass brush to push a cotton cloth through the barrel. Multiple cloths and/or attempts might be required to clean it.
5. Vacuum out any residue, by blocking the air flow from one of the openings.
6. Check the cleanliness of the barrel by looking through it.



Re-assembly

Step 10: Re-assemble die head nozzle subassembly

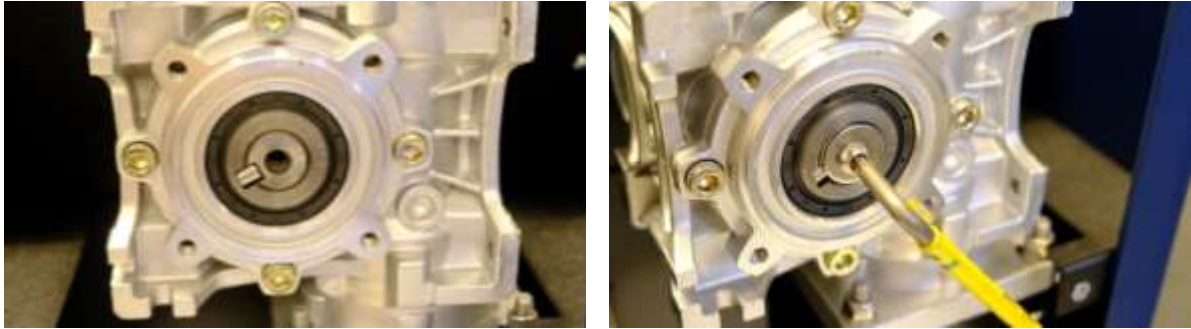
1. Secure the nozzle in the vise and add one of the nozzle gaskets.
2. Place the nozzle connector on top and tighten with wrench. The direction of the connector does not matter, as it is perfectly symmetric.
3. Now place the die head in the vise and add the second of the nozzle gaskets.
4. Place the nozzle connector and nozzle subassembly on top and tighten with wrench.



Step 11: Re-install screw

1. Insert the screw back into the barrel from the front.
2. Insert the key in from the back of the machine. It will rest in the notch in the barrel.
3. Rotate the screw so that it aligns with the key. Push screw in as far as you can, and then push the key in so that they both line up with the side of the motor.
4. Attach small screw with washer to keep the key in place.





Step 12: Re-install die head and nozzle subassembly

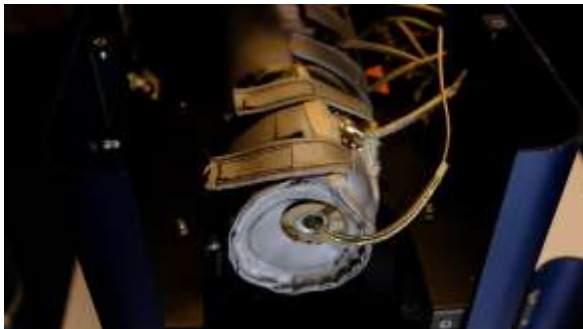
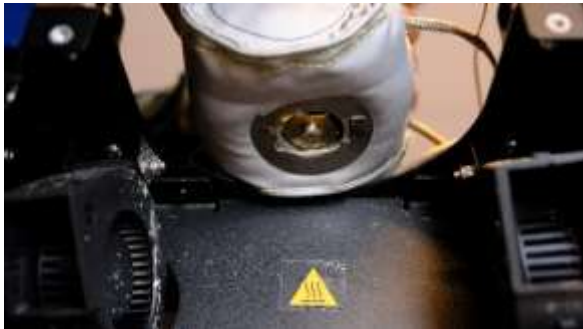
1. Place new graphite gasket. Ensure it lines up neatly and does not misalign on the edge of the die head.
2. Place the die head against the barrel. The two pins on the die head align with the two notches on the barrel. This allows the nozzle to be perfectly vertical, pointing down.
3. Set the die head hook wrench on the die head. Set the barrel hook wrench on the barrel to support it.
4. Tighten the die head.



Step 13: Re-install H4

5. Slide H4 onto the die head, and screw in the two bolts underneath.
6. Re-attach the thermocouple. Tighten it gently as to not damage the thermocouple.
7. Slide the insulation sleeve onto the die head. Line it up with the nozzle first from underneath, then with the thermocouple at the front of the die head.

8. Tighten the two velcro straps on the insulation sleeve.



Step 14: Re-install all panels

1. Attach the small nozzle cover. The hole in the cover fits around the nozzle lip.
2. Hold the cover in place with one hand, then slide the nozzle plate in as far as you can. Check from below to see everything lines up perfectly.
3. Re-install the 3-sided panel assembly with 10 remaining screws.
4. Screw in hopper.



